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The (in)validity of the Ricardian equivalence theorem: Findings from a representative German population survey

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No. 11-2016

Bernd Hayo and Florian Neumeier

**The (In)Validity of the Ricardian Equivalence Theorem—
Findings from a Representative German Population Survey**

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The (In)Validity of the Ricardian Equivalence Theorem— Findings from a Representative German Population Survey

Abstract

In this paper, we utilise data from a German population survey to test the validity of the Ricardian equivalence theorem (RET). In 2013, 2,000 representatively chosen people were asked whether they have altered their consumption and saving behaviour in response to the significant increase in public debt that occurred between 2008 and 2012. Our findings suggest that, in general, RET does not hold. Only 7% of our respondents state that they consume a smaller proportion of their income and save a larger proportion in response to public debt accumulation. Moreover, using multinomial logit regressions, we find that individuals' consumption responses are significantly related to their economic situation, time preferences, education, and age.

JEL: D12; D91; E21; H31

Keywords: Ricardian equivalence; public debt; private consumption; private saving; survey; Germany.

1. Introduction

The recent financial crises and the associated economic downturn have revitalised research into the efficacy of fiscal stimuli and the size of fiscal multipliers. In contrast to ambiguous results in older literature, recent studies report notable and robust effects of fiscal policy on the real economy (e.g., for the United States: Romer and Romer, 2010; Favero and Giavazzi, 2012; for Germany: Hayo and Uhl, 2013; for the United Kingdom: Cloyne, 2013).

These empirical findings are contrary to predictions derived from the Ricardian equivalence theorem (RET), which plays an important role in macroeconomic theory. RET suggests that fiscal stimuli—that is, deficit-financed public spending hikes or tax cuts—will be offset by a crowding out of private consumption, thus decreasing the effectiveness of fiscal policy in boosting economic activity. Although studies showing the effectiveness of fiscal policy may raise doubts about RET's validity, ultimately, they provide only indirect evidence. Hence, reflecting its potential importance, a large number of empirical studies attempt to directly test RET.

The results from these studies lead to very different interpretations. For instance, Seater (1993: 182) states: 'Although tests of Ricardian equivalence do not quite give an unambiguous verdict on that proposition's validity, I think it reasonable to conclude that Ricardian equivalence is strongly supported by the data'. Quite the reverse is claimed by Romer (2006: 572), who writes that 'there is little reason to expect Ricardian equivalence to provide a good first approximation in practice'.

Underlying these results are two dominant strands of empirical research.¹ The first strand employs macroeconomic data to test empirical predictions following from RET. Particularly common is the estimation of (static) aggregate consumption functions as well as consumption Euler equations using multivariate regression analysis or VAR models (e.g., Feldstein, 1982; Evans, 1988, 1991; Becker, 1997). Relying on microeconomic data to check the validity of RET, the second strand utilises laboratory experiments (e.g., Adji et al., 2009; Cadsby and Frank, 1991; Slate et al., 1995). However, findings are generally inconclusive. Within both literature strands, there are some studies that provide evidence in support of RET and some that reject the existence of a Ricardian motive in private consumption. Moreover, both macroeconometric and experimental approaches have been subject to fierce criticism. Macroeconometric studies not only entail a serious identification problem due to the simultaneity of aggregate income, consumption, government revenues, and expenditures, as

¹ See Ricciuti (2003) and Seater (1993) for detailed literature reviews.

well as public debt, but may also suffer from various types of misspecification (e.g., Bernheim, 1987; Cardia, 1997). Experimental laboratory setups, on the other hand, involve hypothetical scenarios and decisions made in a highly artificial environment, thus raising questions about their relevance for daily decision making and casting doubt on their ability to ensure external validity for a representative sample of the population.

There is a third way of testing RET, one that has not been much pursued, namely, directly asking people about their economic reactions. To the best of our knowledge, the only survey-based direct test of RET was attempted by Allers et al. (1998). Those authors utilise data from a mail-in newspaper survey conducted in the Netherlands, where questionnaires were sent out to subscribers of regional newspapers. In the questionnaire, people were asked whether they would save extra money in case of increasing public debt so as to be able to pay higher taxes in the future. The authors' main results, based on descriptive statistics, suggest that respondents do not engage in Ricardian-style behaviour and that those with lower levels of education as well as older respondents are more likely to increase their savings.

We believe that the survey framework, although not without its own problems, is a promising alternative to the other two ways of testing RET. Bearing in mind the methodological drawbacks of the extant literature, we designed a specific population survey to assess the relevance of RET for peoples' consumption choices. In the first quarter of 2013, roughly 2,000 representatively chosen German citizens aged 14 or older were interviewed face-to-face with the help of pen pads. The survey was carried out by the GfK, the largest survey institute in Germany.

The interviewees were asked whether the noticeable increase in public debt in Germany between 2008 and 2012 has affected the share of income they spend or save. We believe the timing of the survey facilitates the purpose of our analysis. The German government's reliance on deficit financing in the aftermath of the recent financial and economic crisis allows us to study changes in private consumption in response to an actual and notable increase in public debt. Thus, in contrast to laboratory studies, our survey refers to a real-world scenario. Relevance is fostered by the fact that the increase in public debt was significant enough to exert a noticeable influence on the government's intertemporal budget constraint. Over the course of the crisis, the debt-to-GDP ratio of the German general government rose from 64.9% in 2007 to 81.1% in 2012. Moreover, the representativeness of our data ensures external validity to a much larger degree than that achieved by using small samples of, typically, economics students. Thus, instead of measuring the response of a specific group to an artificial and counterfactual scenario, we ask a representative sample of

ordinary people about their actual reaction to a real-world event they can relate to and that has been widely and repeatedly discussed in all forms of media.

Our survey allows us to directly link cause—that is, public debt accumulation—and consequence—that is, changes in private consumption. We believe that this approach avoids the type of identification issues commonly afflicting macroeconometric studies and, thereby, provides more direct evidence on the chain of causation.

Moreover, the large number of individual observations makes it possible to investigate whether the inclination to behave in a (non-)Ricardian manner is related to interviewees' personal characteristics. In the extant literature, several studies cast doubt on the general validity of RET by pointing out various restrictive assumptions underlying its theoretical framework. Our survey framework allows us to evaluate the importance of factors believed to invalidate RET, such as economic well-being, time preferences, and (economic) sophistication.

We believe that Allers et al. (1998) do not exploit a number of potential advantages of the survey approach and we improve on their attempt by modifying the research framework in several important ways. First, using state-of-the-art survey methods, the respondents in our sample are representatively and randomly chosen, thereby minimising concern about external validity and selection bias. Hence, the quality of our data makes it possible to draw conclusions for the German population.² Second, the interviews for our analysis were carried out face-to-face by professional interviewers with the help of pen pads, allowing us to ask theoretically interesting and complex questions. Third, our data contain additional information about the respondents, specifically sociodemographic characteristics, time preferences, economic knowledge, and attitudes toward fiscal consolidation, making it possible to test several theoretically informed hypotheses.

Utilising survey data from Germany and Austria, respectively, Heinemann and Henninghausen (2012) and Stix (2013) claim to test RET, too. However, we believe that these scholars provide, at best, an indirect test. They study the association between factors invalidating RET—such as credit constraints or the absence of a bequest motive—and individual support for fiscal consolidation, arguing that persons for whom such invalidating factors are more relevant should favour deficit spending. In our view, this approach suffers from an identification problem as, a priori, it is not clear whether attitudes toward public

² Note that Allers et al. (1998) are aware of the deficiency of their dataset and try to address this issue by computing representative weights for their sample using Census data. However, this type of weighing cannot address possible selection biases.

indebtedness are actually linked to individual consumption behaviour. In fact, in our empirical analysis, we find no statistically significant association between individual attitudes toward fiscal consolidation and a Ricardian consumption motive.

The remainder of the paper is organised as follows. Section 2 introduces the survey and sets out our research hypotheses based on linking consumers' reactions to public debt incurrence to their individual characteristics. In Section 3, we discuss our empirical approach and present our findings. Section 4 concludes.

2. Data and Research Hypotheses

According to Barro (1974, 1979), RET implies that individuals view taxes and public debt as equivalent means of financing public expenditure. Consumers are assumed to be well aware of the government's intertemporal budget constraint and, thus, in the event of a government deficit, anticipate that taxes will need to be raised in the future to repay this debt. Since the optimal level of consumption is supposed to depend on (expected) lifetime income rather than current income, individuals reduce current consumption and increase savings with the aim of smoothing consumption over time. Therefore, any fiscal stimulus created by a deficit-financed tax cut (or expenditure increase) will be offset by an equally sized reduction in private consumption. However, as is widely acknowledged, the validity of RET is sensitive to the assumptions Barro (1974, 1979) makes in his theoretical framework (see, e.g., Romer, 2010).

To assess whether or not individuals alter their consumption behaviour in response to an increase in public debt, we included the following question in our survey:

Between 2008 and 2012, we have seen a rapid acceleration of public debt. Did this increasing reliance on debt financing lead to changes in the way you spend or save?

-
- Yes, I now spend **a smaller proportion** of my income and save **a larger proportion***
- Yes, I now spend **a larger proportion** of my income and save **a smaller proportion***
- No, I did not change my behaviour in consequence to the rapid increase in public debt*
-

RET implies that respondents choose the first option, that is, spend a smaller proportion of income and save a larger proportion. However, we also offered the opposite course of action as an option in our survey; respondents were able to indicate that they spend a larger proportion of their income and save a smaller proportion. Respondents could also choose to answer that they did not alter their consumption behaviour at all.

At the micro level, individual consumption responses to public debt accumulation may vary because people are differently affected by factors invalidating RET. In the following, we discuss some of these factors and derive empirically testable hypotheses to evaluate their importance.³ A detailed description of our survey and the variables, together with descriptive statistics, is provided in Hayo et al. (2014).

Economic well-being. Two arguments in the literature link private consumption and public indebtedness to an individual's personal economic situation. First, Cukierman and Meltzer (1989) provide an extension of Barro's (1979) theoretical framework in which individuals differ in their abilities and, consequently, in the level of earned income. In this framework, people who are comparatively worse-off would like to borrow resources from future generations in order to increase their current consumption. Since individuals are bequest constrained in the sense that they cannot leave a negative bequest, economically deprived people favour deficit spending and, thus, do not reduce consumption in response to public debt incurrence. Second, and in a similar vein, financial market imperfections, such as credit constraints or differential borrowing rates, may invalidate RET (e.g., Heller and Starr, 1979; Hayford, 1989). In this context, public debt can be interpreted as a loan made to the current generation of consumers allowing them to circumvent a binding credit constraint. Since people who are comparably worse-off are more likely to face higher credit costs or even a binding credit constraint, they may be less inclined to reduce consumption in the event of public debt accumulation.

We assess the interviewee's personal economic situation with three different variables, two objective indicators and a subjective one: (i) net monthly household income (in €1,000), (ii) the household's real wealth (a binary variable indicating whether the respondent lives in a self-owned house/flat or a rented house/flat), and (iii) a subjective assessment of the interviewee's personal economic situation, ranging from 1 (absolutely dissatisfied) to 5 (absolutely satisfied).

Time horizon and time preference. The validity of RET is particularly sensitive to the assumptions made concerning the time horizon of the current generation of consumers. More precisely, RET holds only if the current generation that benefits from deficit spending either (i) has to carry the burden of a future debt reduction or (ii) cares about the welfare of future generations, that is, has a bequest motive. At the individual level, the first point relates to a person's remaining life expectancy, whereas the second appears more relevant for people with

³ Sealer (1993) and Ricciuti (2003) provide similar discussions.

children (e.g., Heinemann and Henninghausen, 2012). In the empirical analysis, we use the respondent's age as a proxy for remaining life expectancy and include a dummy variable for respondents with children.

Another crucial assumption underlying RET is that the discount function applied by individuals corresponds to the yield curve of government bonds. However, empirical research on intertemporal choice documents that people's subjective discount factors between two consecutive periods are typically larger than the corresponding interest rate, indicating that they are less forward-looking than assumed (e.g., Thaler and Shefrin, 1981). Both theoretical and empirical evidence suggests that the higher a person's discount rate, the stronger the inclination to opt for deficit spending (e.g., Huber and Runkel, 2008; Hayo and Neumeier, 2016a). Consequently, a high discount rate implies that a person is less likely to reduce consumption in response to public debt accumulation.

To measure the interviewees' time preferences, we include a simple experiment in our survey. Respondents were asked to choose between a safe payoff of €1,000 paid in six months and a higher payoff of € $X_{i,12}$ paid in twelve months. The respondents' choice of $X_{i,12}$ is then used to compute the marginal rate of intertemporal substitution (β) between two consecutive future periods, that is, $\beta = 1,000/X_{i,12}$. The larger β , the lower a person's discount rate.

Knowledge/information set. In Barro's (1979) theoretical framework, people are assumed to be able to evaluate the future burden associated with deficit financing and capable of solving an intertemporal optimisation problem in order to derive their 'optimal' consumption plan. In practice, this requires not only sufficient information about public-debt-related economic measures in order to assess the costs arising from public debt incurrence, but also a certain level of intellectual sophistication. Survey evidence, however, indicates that people are rather ignorant about economic measures in general (Blinder and Krueger, 2004) and public debt in particular (Hayo and Neumeier, 2016a). As argued by Reiter (1999), imperfect information about public debt and the associated costs may invalidate RET, as may a lack of sophistication.

To measure the interviewees' factual knowledge about economic variables necessary for assessing the public debt situation, we asked three multiple-choice questions: (i) the size of the federal government's budget deficit in 2012 (in relation to GDP), (ii) the current interest rate on government bonds with a maturity of 10 years, and (iii) inflation rate in 2012. In each case, respondents could choose from among four answers and we use the total number of correct answers, ranging from 0 to 3, as our indicator of relevant economic information. In the empirical estimations, we employ four dummy variables reflecting the possible number of

correct answers. We further control for the interviewees' level of education so as to capture the effect of intellectual sophistication, differentiating between those who completed lower secondary school (*Hauptschule*), middle secondary school (*Realschule*), upper secondary school (*Abitur*), and those who have not yet completed school.

Further controls. We include additional characteristics of our respondents as control variables. Specifically, we control for the respondents' employment status, differentiating between employed, unemployed, students, and retirees; the interviewees' marital status, differentiating between singles, people living in a partnership, married people, and divorced or widowed people; and respondents' sex. We assessed the respondents' risk attitudes by conducting a simple experiment. Respondents were confronted with the choice of either receiving a safe payoff of €X or taking part in a lottery in which they could win either €1,000 or nothing (the odds are 50:50). The choice of X is then used to compute an individual's risk attitude parameter, which, by construction, varies between -1 (maximum risk aversion) and $+1$ (maximum risk propensity).⁴ Finally, we captured the interviewees' attitudes toward fiscal consolidation by asking whether, in their opinion, the state should reduce public debt, keep public debt at the current level, or incur additional public debt. Both Heinemann and Henninghausen (2012) and Stix (2013) argue that those opposing public debt reduction are less likely to exhibit a Ricardian consumption motive. Thus, they assume that one can identify RET behaviour from individual attitudes toward public debt incurrence.

3. Empirical Findings

We first take a look at bivariate relationships between private consumption responses to public debt incurrence and the covariates described in Section 2. In Table 1, we provide cross-tabulations showing conditional distributions of answers for various subgroups of the German population. In addition, the table contains the results of Pearson's χ^2 tests of the associations' statistical significance.

Our findings suggest that only 7% of our respondents have a reaction to the increase in public indebtedness that is consistent with RET, namely, reducing consumption and increasing savings. The largest share of German citizens—roughly three-quarters—has not adjusted their consumption behaviour at all. Nearly 18% report behaviour that is completely opposite to what RET would expect, that is, they consume a larger part of their income in

⁴ The risk attitude parameter is computed as $\lambda = (X-500)/500$.

response to public debt accumulation. Thus, we have evidence that the vast majority of Germans (93%) do not engage in the economic adjustment implied by RET.

Table 1: Attitudes toward debt brake and public indebtedness—joint distribution of answers

	Consume less	Consume more	No change in consumption	No. of obs.	Cramér's V / Pearson's χ^2
Total	7.00	17.63	75.37	n=2,042	
Low income (< €1,500)	8.72	15.01	76.27	n=493	
Medium income (€1,500–€3,000)	6.17	18.75	75.08	n=1,264	0.040 $\chi^2(4)=6.46$
High income (> €3,500)	7.72	17.19	75.09	n=285	
Dissatisfied with current economic situation	4.77	15.51	79.71	n=419	
Neither/nor	6.93	17.25	75.82	n=765	0.046 $\chi^2(4)=8.45^*$
Satisfied with current economic situation	8.16	19.00	72.84	n=858	
No self-owned house/flat	7.25	16.56	76.19	n=966	0.027 $\chi^2(2)=1.50$
Self-owned house/flat	6.78	18.59	74.63	n=1,076	
Weak future orientation ($\beta \leq .5$)	5.91	16.78	77.30	n=1,269	
Medium future orientation ($.5 < \beta \leq .9$)	8.32	17.23	74.46	n=505	0.056 $\chi^2(4)=12.86^{**}$
Strong future orientation ($\beta > .9$)	9.70	22.39	67.91	n=268	
No correct answer	8.74	16.70	74.56	n=515	
One correct answer	6.40	18.10	75.50	n=906	0.030 $\chi^2(6)=3.62$
Two correct answers	6.24	17.77	75.99	n=529	
Three correct answers	7.61	17.39	75.00	n=92	
Risk averse ($\lambda \leq -0.6$)	7.01	18.29	74.7	n=585	
Risk neutral ($-0.6 < \lambda < 0.6$)	6.16	18.47	75.38	n=796	0.028 $\chi^2(4)=3.26$
Risk prone ($\lambda \geq 0.6$)	8.02	16.04	75.95	n=661	
Lower secondary school	7.48	17.55	74.97	n=735	
Middle secondary school	6.86	18.95	74.19	n=860	
Higher secondary school	6.53	17.09	76.38	n=398	0.052 $\chi^2(6)=12.47^*$
Schooling not yet complete	6.12	0.00	93.88	n=49	

Table 1 (continued)

	Consume less	Consume more	No change in consumption	No. of obs.	Cramér's V / Pearson's χ^2
Age 16–24	8.96	9.43	81.60	n=212	
Age 25–39	8.09	18.60	73.32	n=371	0.063
Age 40–64	6.95	19.53	73.52	n=978	$\chi^2(6)=16.26^{**}$
Age 65+	5.41	16.63	77.96	n=481	
Children	6.46	18.22	75.33	n=1,301	0.033
No children	7.96	16.60	75.44	n=741	$\chi^2(2)=2.23$
Reduce public debt	7.15	17.51	75.34	n=1,525	
Keep debt constant	7.02	17.98	75.00	n=484	0.025
Incur additional public debt	0.00	18.18	81.82	n=33	$\chi^2(4)=2.56$

Notes: First three columns show conditional distribution of answers in percent. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

There are at least two possible explanations for why almost one-fifth of our respondents report consuming a larger share of their income. First, the decrease in propensity to save may reflect widespread fear of an increase in inflation rates caused by the large fiscal stimulus. However, Consensus Economics forecasts reported that long-term inflation expectations in the euro area were close to 2% in 2012 and early 2013. Alternatively, break-even inflation rates, a financial market-based indicator of future inflation, signal that from mid-2012 onward, inflation expectations started a downward slide that lasted until early 2014.⁵ Moreover, the inflation explanation does not necessarily support important aspects of RET. Arguably, it implies that people undertake financial planning within a limited time horizon, as a hike in inflation rates would make it less painful for households to pay the higher taxes needed in the future to repay public debt. Hence, we believe that the ‘fear of inflation’ explanation is unlikely.

Second, the government’s fiscal behaviour may have shifted peoples’ opinion about consumption and saving.⁶ Decisions about the ‘appropriate’ share of income to save and consume may not be affected only by economic calculus, but also by socially constituted

⁵ Break-even inflation rates are computed as the spread between the yield on a nominal bond and that on an inflation-linked bond of the same maturity.

⁶ Empirical evidence suggests that public opinions about various issues, such as public spending, taxation, and regulation, are, indeed, influenced by politics as well as by policymakers (e.g., Page et al., 1987; Page and Shapiro, 1983). Thus, political decisions are not just a mere reflection of public opinion as many public choice approaches suggest.

norms and values. In social psychology, an important approach to explaining individual behaviour is ‘social identity theory’ (see, e.g., Tajfel, 1978, Turner et al., 1987). Akerlof and Kranton (2010) integrate this concept into a traditional microeconomics framework, which is based on the idea that individuals try to bolster self-esteem via group membership. If individuals identify themselves with a group, and this membership is a salient feature of an individual’s personality, it is likely that the individual will adjust his or her behaviour to match that of the group. If we assume now that the government is a focal point for a majority of voters, its fiscal behaviour may establish a ‘standard’ to be followed for many citizens. The decline in fiscal discipline may have altered the general public’s attitude toward saving and consumption, leading to an increase in aggregate spending. Social identity theory is obviously a very different theoretical framework than RET, less rigorous and not necessarily in accordance with standard economic theory. However, using social stratification theory, Hayo and Neumeier (2014, 2016b) have more success in explaining government deficits in Germany and the OECD countries than do the typical public choice approaches. Thus, it could be that consumption and saving decisions are more affected by subconscious modes of thinking than by intertemporal optimisation.

To sum up, at the aggregate level, we find no support for RET but instead find economic reactions suggesting either the practical irrelevance of RET or a dominating influence of noneconomic influences, as, for instance, provided by social identity theory.

Moving from the aggregate perspective to the distribution of answers within various subgroups of the German population, we find that respondents who assess their personal economic situation as good, have a strong future orientation, and are younger are somewhat more likely to behave in a Ricardian manner, that is, they are more inclined to consume a smaller share of their income in reaction to public debt accumulation. At the same time, the absolute share of interviewees stating that they increased consumption is also higher within these subgroups of the population, which contradicts our research hypotheses. Put differently, it appears that the well-to-do, people who are forward-looking, and younger persons are more likely to adjust consumption when the government takes on additional debt—but not in a notable way.

We find no significant association between individual attitudes toward public debt incurrence and consumption behaviour. This finding casts doubt on the validity of the identification scheme put forward by Heinemann and Henninghausen (2012) and Stix (2013), who argue that one can draw conclusions about a Ricardian motive from individual attitudes toward fiscal consolidation and vice versa. In contrast, our results suggest that the share of

respondents who actually consume a larger part of their income in response to public debt accumulation is roughly the same across supporters and opponents of fiscal consolidation.

Although cross-tabulations are very useful for studying the associations between the variables of interest, as they do not require assumptions about the underlying functional relationships, they do not take the joint variation of the covariates into consideration and, thus, do not have a *ceteris paribus* interpretation. To account for potential collinear relationships between our covariates, we continue our analysis using multinomial logit regressions. The estimation results are shown in Table 2.

Among the group of economic variables, subjective assessment of personal economic well-being is significantly positively related to the propensity to consume. Thus, when controlling for the influence of other factors, we still obtain the same result as in our bivariate analysis. The more satisfied the respondent is with her economic situation, the higher the likelihood that she behaves in accordance with RET, that is, that she reduces consumption in response to public debt accumulation. Considering the magnitude of the reaction, we find that a 1 point increase in the indicator for subjective economic well-being is associated with a 2 percentage points (pp) higher likelihood of reducing consumption expenses and a 3 pp lower likelihood of not adjusting consumption at all.

A respondent's employment status exerts a particularly strong effect on consumption behaviour. Unemployed and retired people are significantly less likely to reduce consumption following the increase in public debt than are regularly employed people. This could be because the former groups are credit constrained and less likely to be affected by a future tax increase seeing as they do not pay income tax. The average marginal effects are -5 pp and -3 pp, respectively. Students and trainees/members of the military are significantly less likely to consume a larger part of their income than are employed persons and, at the same time, more likely not to change their consumption and saving behaviour at all. The effects are of notable size: a student (trainee) has an 18 pp (9 pp) lower likelihood of spending more and saving less than an employee and a 21 pp (11 pp) higher likelihood of not adjusting her consumption expenses, indicating that these groups are in general less responsive to public debt incurrence.

Table 2: Determinants of individual consumption response to public debt accumulation

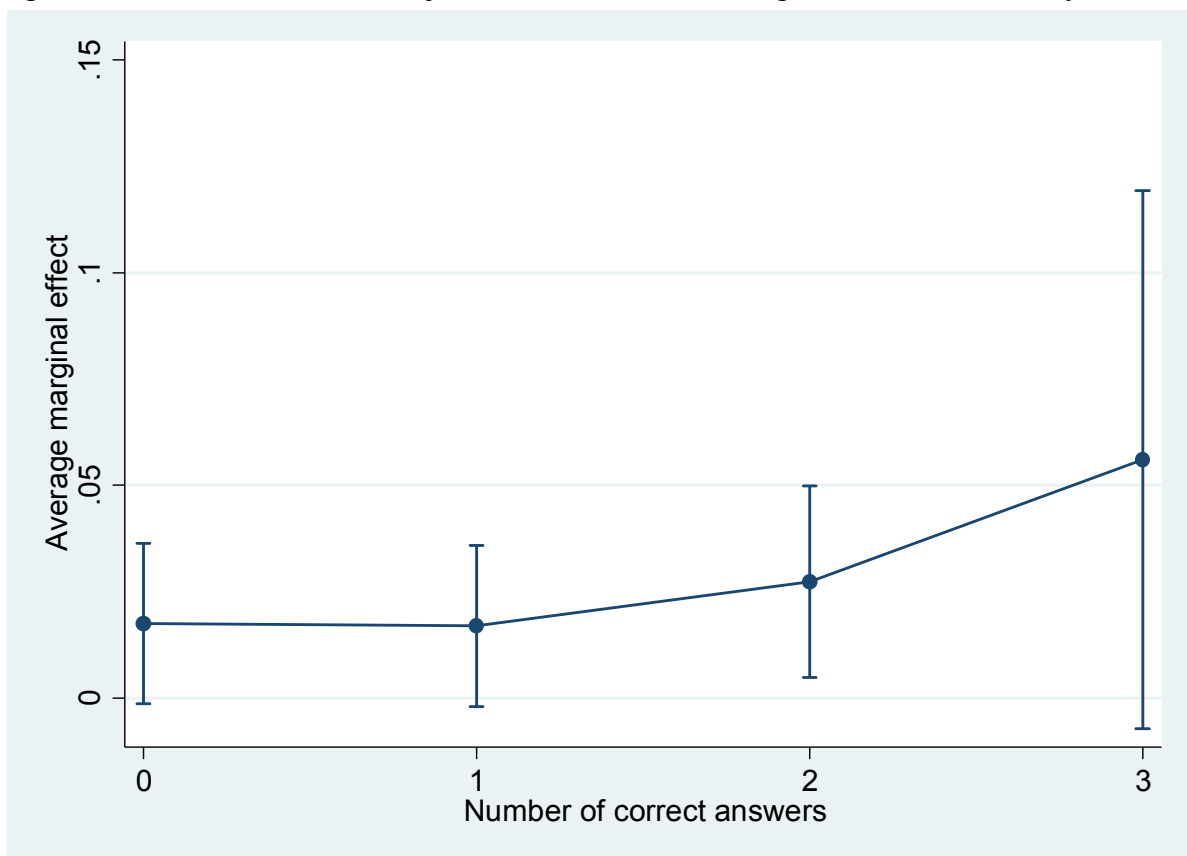
Variables	Consume less	Consume more	No change in consumption
<i>Economic situation</i>			
HH income	-0.011	-0.001	0.012
Subjective well-being	0.021***	0.010	-0.030***
Property	-0.003	0.030*	-0.0298
<i>Time preferences/horizon</i>			
β	0.050*	0.056	-0.106**
Age	-0.0003	0.001	-0.0003
Children	-0.002	0.009	-0.007
<i>Economic literacy</i>			
No correct answers (reference category)			
One correct answer	-0.025	0.009	0.016
Two correct answers	-0.029*	0.003	0.026
Three correct answers	-0.012	0.004	0.008
<i>Education</i>			
Lower second. school (reference category)			
Middle second. school	-0.017	0.010	0.007
Higher second. school	-0.020	-0.004	0.023
<i>Employment</i>			
Employed (reference category)			
Unemployed	-0.050**	-0.009	0.059
Retired	-0.034**	-0.055**	0.089***
Student	-0.014	-0.175***	0.210***
Voc. training/military service	-0.034	-0.094***	0.107***
Housewife/househusband	-0.002	0.052	-0.052
<i>Other controls</i>			
Female	0.011	-0.032*	0.021
Living in partnership	-0.031	0.008	0.023
Married	-0.015	-0.055	0.070*
Divorced/widowed	-0.015	-0.022	0.037
Risk attitudes	0.008	-0.017	0.009
Observations	2042		
Pseudo-R ²	0.03		
Wald χ^2 (40)	8033***		

Notes: Results are based on multinomial logit maximum likelihood estimation. Marginal effects based on sample averages are reported. White (1980) robust standard errors are used. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

We now investigate whether there are interaction effects between the explanatory variables in our regression model. In a first step, we interact our indicator capturing the respondents' economic literacy with, on the one hand, the economic indicators and, on the other hand, the time preference indicators. Arguably, if people are unaware of the current fiscal situation, they may not alter consumption behaviour in response to an increase in public debt—regardless of their economic situation or time preferences. Our findings suggest that the marginal effect of respondents' subjective economic well-being is systematically related to

their economic literacy. This relationship is illustrated in Figure 1. The better informed a person is about economic variables helpful for assessing government debt, the greater the marginal effect of economic well-being on the likelihood of acting in accordance with RET. A 1 point increase in the indicator for subjective economic well-being is associated with a roughly 2 pp higher likelihood of reducing consumption if respondents are poorly informed about economic indicators. For those who have answered two/three questions correctly, this effect grows to 3 pp/6 pp. The marginal effects of other economic indicators and the time preference indicators do not vary systematically with the degree of economic literacy.⁷

Figure 1: Interaction effect of subjective economic well-being and economic literacy



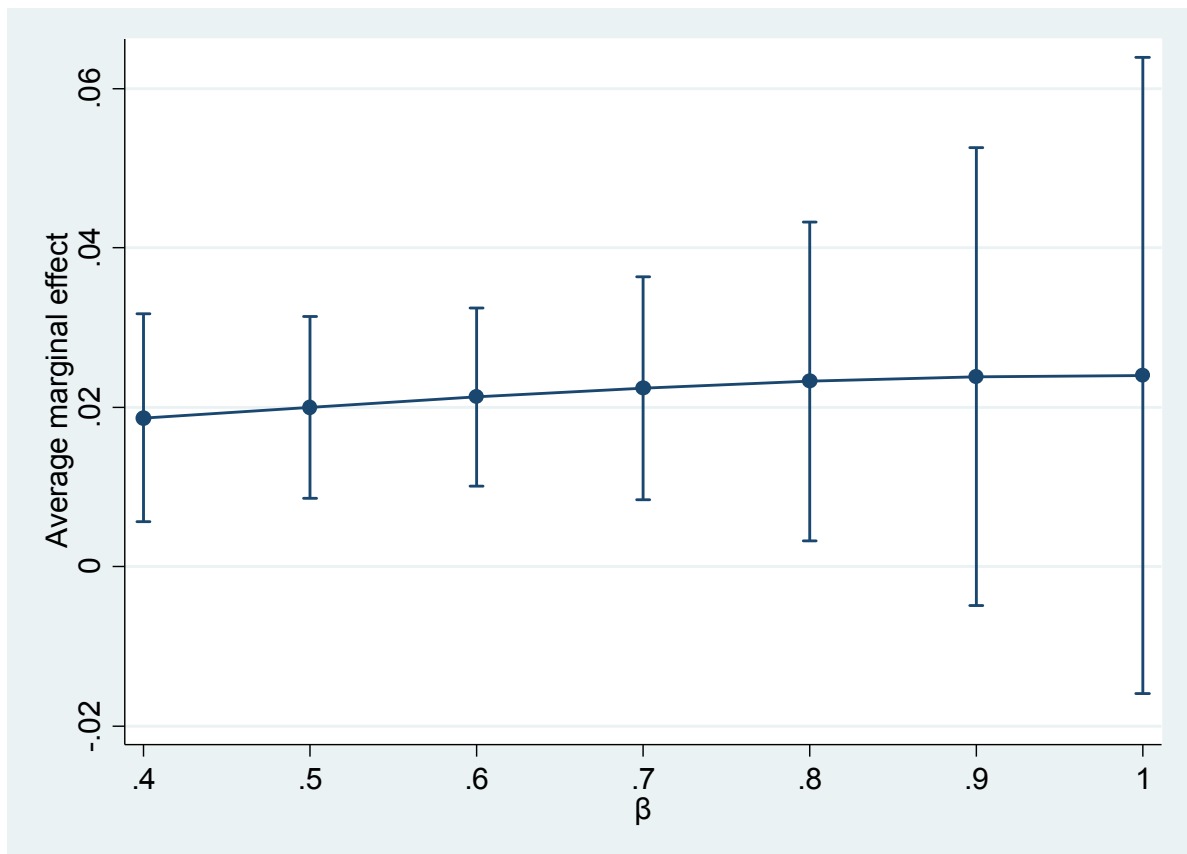
Notes: The figure shows average marginal effects of subjective well-being for different realizations of the economic literacy indicator along with 90% confidence intervals.

Next, we consecutively interact our time preference indicators—i.e., the variables β , *age*, and *children*—with the economic variables and our indicator capturing the respondents' economic knowledge. Our hypothesis is that people who are particularly present oriented may not care much about a future tax increase and, thus, will tend not to react in accordance with RET. As in the case of economic literacy, only the marginal effect of the respondents'

⁷ Results are available on request.

subjective economic well-being varies with time preferences. The larger β , the more likely it is that persons assessing their economic situation as good behave in line with RET. Figure 2 shows the marginal effect of subjective well-being on the likelihood of consuming less and saving more for different in-sample realisations of β . The marginal effect of subjective economic well-being for people who are particularly concerned about the present—i.e., who have a β of 0.4—is as low as 1.9 pp. In contrast, for people who are relatively forward-looking ($\beta=1$), the likelihood of saving more and consuming less in response to public debt acceleration increases by 2.2 pp with every 1 point increase in the well-being indicator. However, estimation uncertainty is quite high, especially for high values of β and, consequently, the differences in marginal effects are not statistically significant. Finally, the marginal effect of subjective well-being does not appear to be related to other indicators of respondents' time horizons, that is, age and having children.⁸

Figure 2: Interaction effect of subjective economic well-being and β



Notes: The figure shows average marginal effects of subjective well-being for different realizations of β along with 90% confidence intervals.

⁸ Results are available on request.

4. Concluding Remarks

In this paper, we test the validity of the Ricardian equivalence theorem (RET) using a survey-based approach, which we believe has a number of advantages compared to macroeconometric or experimental laboratory studies. Employing data from a specifically designed, representative German population survey carried out in 2013, we investigate whether interviewees have altered their consumption and saving behaviour in response to the recent notable increase in public debt. The dataset consists of about 2,000 observations and contains a great deal of information about our respondents, which allows us to evaluate the importance of a number of factors believed to invalidate RET, thereby putting theoretically informed hypotheses to an empirical test. Our specific research design improves upon the existing survey literature on RET, as it avoids serious problems of identification, as encountered by Heinemann and Henninghausen (2012) and Stix (2013), as well as selection biases, possibly affecting the study by Allers et al. (1998).

Interpreting the results of the previous empirical literature, Barro (1989, 49) concludes that ‘results are all over the map, with some favoring Ricardian equivalence, and others not’. In contrast, our study clearly suggests that RET does not hold. Only 7% of our respondents state that they consume a smaller proportion of their income and save a larger proportion in response to the recent increase in public debt. About 18% even claim that they have done the opposite of what would be expected by RET, that is, they consume a larger part of their income in response to public debt accumulation. The largest fraction of our respondents, roughly three-quarters, state that they did not alter their consumption and saving behaviour at all. We discuss two explanations for our findings at the aggregate level: (i) widespread fear of inflation and (ii) alternative behavioural assumptions. Our conclusion is that fear of inflation is not a likely explanation, whereas alternative behavioural assumptions may explain our results. In particular, social identity theory could be employed to argue that the government’s fiscal behaviour may have shifted peoples’ opinion about consumption and saving. Put differently, the government sector may act as a role model for the household sector.

At the individual level, we find that people who assess their personal economic situation as good, are more forward-looking, and younger are more likely to react to public debt incurrance, but not in a systematic way, as both the share of respondents who have reduced consumption as well as the share of those who consume more is still larger within these groups. Other hypotheses related to time preference and time horizon, knowledge/information set, and other controls receive no direct empirical support.

Studying interaction effects of subjective economic well-being and economic literacy provides some evidence in support of the hypothesis that RET-consistent behaviour is more likely if economic actors are better informed. The interaction effect between subjective economic well-being and time preference suggests that more patient individuals tend to react more in line with RET.

Thus, at least some aspects of intertemporal optimisation behaviour seem to be relevant for the German reaction to fiscal deficits. However, overall, we have to conclude that RET has little practical relevance for people's economic behaviour.

Like all research methods, our survey-based approach has a number of potential drawbacks. First, we are measuring stated behaviour and not actual behaviour, which are not necessarily the same. One reason for such noncongruence could be errors in recollection. However, given that the public debt situation received extensive coverage in all forms of mass media, this does not seem particularly likely. Moreover, deviations may occur in both directions and, therefore, cancel out across the sample. Another reason could be social desirability bias, as respondents may try to please the interviewer rather than stating their own views. We do not think that such bias is a major problem here as it is not obvious what the socially desired answer to the relevant survey question should be. Moreover, pre-tests did not indicate that respondents felt obliged to answer the question in a particular way.

Second, there could be issues related to sampling errors. While these can never be completely avoided, our sample is carefully chosen and corresponds in many core aspects to the profile of the general population. Employing professional interviewers makes it less likely that different survey processes were used for different respondents or that the respondents misunderstood the survey questions.

Third, our analysis may suffer from problems of operationalisation, that is, our empirical indicators may not capture our theoretical variables of interest very well. For instance, proxying wealth by homeownership may be problematic if people hold very different assets in their respective portfolios. Additionally, our indicator for time preference could be problematic, as it suffers from the same problem pertaining to many experimental laboratory studies, namely, that the setup is very artificial.

Fourth, in terms of interpretation, we are neither able to assess by how much consumption and saving have changed in response to the recent rise in public debt nor in what direction the aggregate effect goes, that is, whether aggregate consumption and saving have increased or decreased. However, given that the share of respondents who reduce consumption is very low across all income groups and also much lower than the share of people who state that they

increased spending, it is tempting to conclude that a deficit-financed fiscal stimulus can lead to a crowding-in of private consumption rather than a crowding-out. Whether this result is particular to our analysis of a specific country in a specific economic situation as well as the development of a consistent theoretical framework explaining this behaviour goes beyond the scope of our paper and must be left for future research.

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